



U.S. DEPARTMENT OF
ENERGY

**Report on Technology Transfer
and Related Technology
Partnering Activities at the
National Laboratories and Other
Facilities for Fiscal Year 2014**

**Report to Congress
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**United States Department of Energy
Washington, DC 20585**

Friction Stir Welding for Fuel-Efficient Vehicles (Pacific Northwest National Laboratory)

To reduce the weight of vehicles for greater fuel efficiency and fewer emissions, a joining process called friction stir welding was transferred to industry for creating quality lighter-weight welded panels made of aluminum. A team including Pacific Northwest National Laboratory (PNNL), General Motors, TWB Company LLC, and Alcoa developed and deployed the technology for high-volume automotive use. This research was funded by DOE's Office of Energy Efficiency and Renewable Energy-Vehicle Technologies Office.

Conventional laser welding technologies have been used for welding steel blanks, which are "stamped" to create vehicle parts. Laser welding, however, has proven to be more problematic for joining the more lightweight aluminum alloys.

The DOE-PNNL industry team turned to friction stir welding, which was originally patented by others in the early 1990s for the aerospace industry. Over a three-year period, the team devised a way to use the same technology to join aluminum sheets of various thicknesses at much higher welding speeds to support the high volume required by the automotive sector, without melting the material or compromising the integrity of the vehicle or passenger safety.

What made this technology transfer so successful was involving the entire supply chain in the development and transfer, including R&D partners, the material supplier, the component supplier, and the end user/vehicle manufacturer. The partnership resulted in this technology being used for the *first time* for both equal- and dissimilar-thickness joining of aluminum alloys at welding velocities that support high-volume production.

Since this technology was transferred to TWB Company LLC, the company now can join more than 200,000 automotive components on a single machine and can provide welded aluminum blanks to the domestic automotive market in support of production of lighter, more efficient vehicles. Alcoa was able to expand automotive product lines supporting production of aluminum welded blanks. GM gained significant technical knowledge for how the company could apply the technology to future vehicle production. Additionally, it now has a qualified supplier for aluminum welded blanks.

The technology transfer advances U. S. economic competitiveness while supporting the goal of more energy-efficient and environmentally friendly highway transportation technologies that will enable the nation to use less petroleum.



Attendees compare a 40-lb door and a 25-lb aluminum prototype at the American Energy and Manufacturing Competitiveness Summit in September 2014 in Washington, D.C.